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## TECHNICAL NOTE

D-1612

PRESSURE DISTRIBUTIONS OVER THE FORWARD PORTION  
OF THE PROJECT FIRE SPACE-VEHICLE CONFIGURATION AT  
MACH NUMBERS FROM 0.25 TO 0.60

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
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SUMMARY

An investigation was made in the Langley 7- by 10-foot transonic tunnel to determine the pressure distributions over a 0.0628-scale model of the forward portion of the Project Fire space-vehicle configuration. Tests were made at Mach numbers of 0.248, 0.395, and 0.585. Data are presented for the model at angles of attack ranging from  $-8^\circ$  to  $8^\circ$  and at roll angles of  $0^\circ$ ,  $15^\circ$ ,  $30^\circ$ ,  $50^\circ$ , and  $90^\circ$ .

INTRODUCTION

Project Fire is a flight reentry program being conducted by the National Aeronautics and Space Administration for the purpose of studying total heat transfer, ultrahigh-temperature air radiance, materials response, and radio blackout effects at hyperbolic velocities. The Project Fire vehicle consists of a reentry package which is attached by an adapter to an Antares II-A2 rocket motor. These components are enclosed by a shroud and a guidance-unit shell. This assembly (designated velocity package) is mounted by means of an adapter to an Atlas D first-stage launch vehicle, which will launch the velocity package on a ballistic trajectory. Prior to reentry, the Antares motor will accelerate the reentry package to a velocity of about 37,000 feet per second. When this velocity is reached, the reentry package separates from the Antares motor and reenters the atmosphere.

The purpose of this paper is to present subsonic pressure distributions over the forward portion of the Project Fire space-vehicle configuration to aid in the structural design of this configuration. The tests were made in the Langley 7- by 10-foot transonic tunnel at Mach numbers from 0.25 to 0.60 and at angles of attack from  $-8^\circ$  to  $8^\circ$ .

## SYMBOLS

|            |  |
|------------|--|
| $C_p$      | pressure coefficient, $\frac{p_l - p_\infty}{q_\infty}$  |
| $l$        | length of model, in.   |
| M          | Mach number  |
| $p_\infty$ | free-stream static pressure, lb/sq ft  |
| $p_l$      | local orifice pressure, lb/sq ft   |
| $q_\infty$ | free-stream dynamic pressure, lb/sq ft   |
| R          | Reynolds number based on a length of 1 foot  |
| x          | orifice location measured from model nose, in.   |
| $\alpha$   | angle of attack, deg   |
| $\phi$     | angle of roll of orifices, measured clockwise from the vertical as viewed from rear of model, deg (see fig. 1) |

## MODEL

Details of the 0.0628-scale model tested are given in figure 1, and a photograph is presented in figure 2. The model represents the velocity package attached by an adapter to a portion of an Atlas D first-stage launch vehicle. The model was sting supported and instrumented with forty-two 0.043-inch-diameter pressure orifices located along the surface. In order to simplify construction, a single row of orifices was used, and the model was rotated through the angle  $\phi$  to obtain the complete pressure distributions. (See fig. 1.)

## TESTS AND CORRECTIONS

The investigation was made in the Langley 7- by 10-foot transonic tunnel at Mach numbers of 0.248, 0.395, and 0.585 which correspond to dynamic pressures of 87.8, 207.9, and 403.9 pounds per square foot, respectively. The Reynolds number per foot for each test Mach number is shown in figure 3. Pressure orifices were used to measure the pressures along the model (which are presented in the form of pressure coefficient  $C_p$ ) for an angle-of-attack range of  $-8^\circ$  to  $8^\circ$  and for roll angles of  $0^\circ$ ,  $15^\circ$ ,  $30^\circ$ ,  $50^\circ$ , and  $90^\circ$ . The tests were conducted without artificial transition strips placed on the model.

The angles of attack have not been corrected for the deflections of the sting-support system under load; however, it was estimated that the maximum correction would be about  $\pm 0.1^\circ$ . The accuracy of the pressure coefficients is estimated to be within the following limits:

| M               | $C_p$        |
|-----------------|--------------|
| 0.248 . . . . . | $\pm 0.0400$ |
| 0.395 . . . . . | $\pm 0.0150$ |
| 0.585 . . . . . | $\pm 0.0060$ |

### PRESENTATION OF RESULTS

The pressure coefficients are presented in tables I, II, and III for Mach numbers of 0.248, 0.395, and 0.585, respectively. Representative plots of the pressure distributions over the model are presented as follows:

#### Figure

|   |   |
|---|---|
| The combined effect of Reynolds number and Mach number on the pressure distribution over the model. $\alpha = 0^\circ$ ; $\phi = 0^\circ$ . . . . . | 4 |
| The effect of angle of attack on the pressure distribution over the model. $\phi = 0^\circ$ ; $M = 0.585$ . . . . .                                 | 5 |
| The effect of angle of attack on the pressure distributions over the model. $\phi = 90^\circ$ ; $M = 0.585$ . . . . .                               | 6 |
| The effect of roll angle on the pressure distribution over the model. $\alpha = 0^\circ$ ; $M = 0.585$ . . . . .                                    | 7 |
| The effect of roll angle on the pressure distribution over the model. $\alpha = 8^\circ$ ; $M = 0.585$ . . . . .                                    | 8 |

### SUMMARY OF RESULTS

A detailed discussion of the results obtained in the low-speed investigation of the pressure distributions over the forward portion of the Project Fire space-vehicle configuration has been omitted in order to expedite publication of the data. However, some of the results obtained in the investigation are mentioned here. Increasing the Mach number to 0.395 and the Reynolds number to  $2.53 \times 10^6$  resulted in essentially no change in the pressures obtained over most of the model surface; however, further increases in the Mach number and Reynolds number resulted in slight increases in the pressures. (See fig. 4.) At the low roll angles (corresponding to the upper surface of the model) the pressures obtained over most of the model length were decreased with increasing angle of attack. (See fig. 5.) However, at the higher roll angles (corresponding to the side of the model) variations in the angle of attack had no significant effect on the pressure distribution. (See fig. 6.) Increasing the roll angle from  $0^\circ$  to  $90^\circ$

had no significant effect on the pressures obtained on the model at angles of attack of  $0^{\circ}$  and  $8^{\circ}$ . (See figs. 7 and 8.)

Langley Research Center,  
National Aeronautics and Space Administration,  
Langley Station, Hampton, Va., November 20, 1962.

TABLE I

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.248$ (a)  $\alpha = -8^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | .9220               | .9294      | .9358      | .9754      | 1.0018     |
| .005  | .7003               | .6795      | .6465      | .5886      | .3666      |
| .010  | .3436               | .3238      | .2940      | .2137      | -.0174     |
| .020  | .2545               | .2277      | .2041      | .1516      | -.0103     |
| .040  | .2955               | .2781      | .2600      | .2137      | .1035      |
| .060  | .2786               | .2589      | .2333      | .1921      | .1012      |
| .079  | .2714               | .2564      | .2382      | .1993      | .1059      |
| .099  | .2593               | .2469      | .2235      | .1921      | .0988      |
| .139  | .2135               | .2108      | .1871      | .1564      | .0585      |
| .179  | .0810               | .0690      | .0461      | .0250      | -.0458     |
| .198  | -.0130              | -.0175     | -.0317     | -.0562     | -.1311     |
| .208  | -.1600              | -.1713     | -.1799     | -.1994     | -.2662     |
| .227  | -.3553              | -.4165     | -.4400     | -.4526     | -.5198     |
| .237  | -.0974              | -.0968     | -.0973     | -.1087     | -.1406     |
| .257  | -.0613              | -.0656     | -.0827     | -.0873     | -.1097     |
| .276  | -.0564              | -.0632     | -.0755     | -.0801     | -.0837     |
| .302  | -.1600              | -.1617     | -.1630     | -.1494     | -.0956     |
| .311  | -.0637              | -.0824     | -.0973     | -.1064     | -.0814     |
| .331  | .2352               | .2277      | .2090      | .1826      | .0870      |
| .351  | .1653               | .1603      | .1312      | .1396      | .1059      |
| .371  | .1725               | .1603      | .1482      | .1396      | .1083      |
| .391  | .2207               | .2133      | .1968      | .1826      | .1462      |
| .412  | .2496               | .2469      | .2308      | .2112      | .1604      |
| .422  | .2159               | .2060      | .1895      | .1659      | .1154      |
| .442  | .1894               | .1844      | .1628      | .1491      | .0893      |
| .461  | .1894               | .1867      | .1579      | .1420      | .0774      |
| .481  | .1725               | .1652      | .1458      | .1277      | .0703      |
| .505  | .1604               | .1483      | .1336      | .1182      | .0537      |
| .525  | .1436               | .1387      | .1312      | .1062      | .0443      |
| .564  | .1291               | .1123      | .1020      | .0871      | .0230      |
| .604  | .1002               | .0906      | .0704      | .0536      | -.0126     |
| .644  | .0761               | .0738      | .0607      | .0536      | -.0197     |
| .683  | .0520               | .0498      | .0388      | .0274      | -.0387     |
| .723  | .0279               | .0234      | .0048      | -.0037     | -.0743     |
| .763  | -.0058              | -.0030     | -.0317     | -.0371     | -.1051     |
| .802  | -.0950              | -.0968     | -.1071     | -.1207     | -.1714     |
| .822  | -.1842              | -.1882     | -.1946     | -.1947     | -.2496     |
| .851  | -.3408              | -.3444     | -.3526     | -.3547     | -.3894     |
| .861  | -.2011              | -.2146     | -.2091     | -.2138     | -.2496     |
| .881  | -.1432              | -.1498     | -.1581     | -.1541     | -.1808     |
| .921  | -.0998              | -.1065     | -.1119     | -.1135     | -.1382     |
| .960  | -.1119              | -.1065     | -.1119     | -.1159     | -.1335     |

TABLE I.- Continued

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.248$ (b)  $\alpha = -4^\circ$ 

| $x/\zeta$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-----------|---------------------|------------|------------|------------|------------|
|           | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000      | .9385               | .9201      | .9382      | 1.0040     | 1.0018     |
| .005      | .5557               | .5582      | .5468      | .5203      | .3682      |
| .010      | .1728               | .1770      | .1628      | .1281      | -.0006     |
| .020      | .1364               | .1387      | .1166      | .0968      | .0160      |
| .040      | .2068               | .2105      | .1992      | .1859      | .1271      |
| .060      | .2043               | .1985      | .1919      | .1738      | .1318      |
| .079      | .2019               | .2010      | .1944      | .1811      | .1342      |
| .099      | .1898               | .1865      | .1750      | .1738      | .1177      |
| .139      | .1462               | .1458      | .1336      | .1306      | .0798      |
| .179      | .0105               | .0140      | .0072      | .0054      | -.0384     |
| .198      | -.0791              | -.0747     | -.0876     | -.0908     | -.1401     |
| .208      | -.2270              | -.2233     | -.2383     | -.2304     | -.2630     |
| .227      | -.4280              | -.4534     | -.5057     | -.4974     | -.5136     |
| .237      | -.1421              | -.1323     | -.1362     | -.1221     | -.1164     |
| .257      | -.0937              | -.0891     | -.1022     | -.0884     | -.0951     |
| .276      | -.0791              | -.0771     | -.0925     | -.0812     | -.0691     |
| .302      | -.1397              | -.1371     | -.1508     | -.1269     | -.0881     |
| .311      | -.1033              | -.0987     | -.1094     | -.1005     | -.0715     |
| .331      | .1801               | .1818      | .1676      | .1618      | .1223      |
| .351      | .1389               | .1410      | .1312      | .1402      | .1460      |
| .371      | .1438               | .1507      | .1385      | .1353      | .1483      |
| .391      | .1922               | .1914      | .1750      | .1835      | .1862      |
| .412      | .2164               | .2154      | .2066      | .2051      | .1886      |
| .422      | .1801               | .1794      | .1676      | .1642      | .1554      |
| .442      | .1534               | .1458      | .1409      | .1425      | .1294      |
| .461      | .1438               | .1410      | .1215      | .1306      | .1153      |
| .481      | .1292               | .1338      | .1142      | .1137      | .0988      |
| .505      | .1171               | .1123      | .0971      | .1017      | .0798      |
| .525      | .0977               | .1027      | .0850      | .0776      | .0703      |
| .564      | .0783               | .0763      | .0631      | .0608      | .0467      |
| .604      | .0468               | .0475      | .0291      | .0391      | .0207      |
| .644      | .0372               | .0428      | .0291      | .0343      | .0065      |
| .683      | .0105               | .0211      | .0023      | .0103      | -.0172     |
| .723      | -.0186              | -.0147     | -.0341     | -.0186     | -.0479     |
| .763      | -.0597              | -.0507     | -.0706     | -.0571     | -.0833     |
| .802      | -.1421              | -.1298     | -.1483     | -.1366     | -.1637     |
| .822      | -.2197              | -.2185     | -.2383     | -.2111     | -.2394     |
| .851      | -.3699              | -.3672     | -.3890     | -.3724     | -.3789     |
| .861      | -.2245              | -.2258     | -.2431     | -.2256     | -.2394     |
| .881      | -.1663              | -.1563     | -.1726     | -.1678     | -.1802     |
| .921      | -.1179              | -.1179     | -.1289     | -.1197     | -.1235     |
| .960      | -.1106              | -.1011     | -.1216     | -.1100     | -.1117     |

TABLE I.- Continued

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.248$ (c)  $\alpha = 0^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | .9343               | .9946      | .9969      | 1.0136     | 1.0019     |
| .005  | .3959               | .4104      | .4056      | .4136      | .3793      |
| .010  | -.0007              | .0098      | .0129      | .0200      | -.0004     |
| .020  | .0185               | .0360      | .0297      | .0320      | .0350      |
| .040  | .1315               | .1505      | .1446      | .1472      | .1435      |
| .060  | .1387               | .1505      | .1470      | .1568      | .1411      |
| .079  | .1339               | .1480      | .1470      | .1544      | .1481      |
| .099  | .1243               | .1361      | .1374      | .1423      | .1317      |
| .139  | .0834               | .0956      | .0967      | .1064      | .0939      |
| .179  | -.0368              | -.0308     | -.0302     | -.0184     | -.0288     |
| .198  | -.1329              | -.1214     | -.1140     | -.1096     | -.1466     |
| .208  | -.2795              | -.2669     | -.2720     | -.2585     | -.2716     |
| .227  | -.4935              | -.4886     | -.5114     | -.5008     | -.5027     |
| .237  | -.1498              | -.1357     | -.1331     | -.1288     | -.1184     |
| .257  | -.1040              | -.0904     | -.0925     | -.0904     | -.0924     |
| .276  | -.0801              | -.0713     | -.0757     | -.0712     | -.0641     |
| .302  | -.1137              | -.1023     | -.1043     | -.1000     | -.0877     |
| .311  | -.0896              | -.0785     | -.0757     | -.0760     | -.0593     |
| .331  | .1267               | .1409      | .1374      | .1448      | .1458      |
| .351  | .1363               | .1457      | .1374      | .1448      | .1576      |
| .371  | .1339               | .1505      | .1398      | .1496      | .1599      |
| .391  | .1700               | .1862      | .1781      | .1856      | .1954      |
| .412  | .1916               | .2052      | .1949      | .2024      | .2118      |
| .422  | .1531               | .1647      | .1566      | .1664      | .1717      |
| .442  | .1243               | .1289      | .1255      | .1376      | .1387      |
| .461  | .1123               | .1194      | .1110      | .1208      | .1293      |
| .481  | .0906               | .0979      | .1039      | .1016      | .1104      |
| .505  | .0786               | .0836      | .0752      | .0848      | .0963      |
| .525  | .0642               | .0717      | .0680      | .0655      | .0869      |
| .564  | .0401               | .0479      | .0440      | .0512      | .0656      |
| .604  | .0113               | .0241      | .0106      | .0224      | .0373      |
| .644  | .0041               | .0121      | .0177      | .0272      | .0185      |
| .683  | -.0175              | -.0141     | -.0134     | -.0016     | -.0099     |
| .723  | -.0560              | -.0522     | -.0565     | -.0425     | -.0475     |
| .763  | -.0848              | -.0809     | -.0876     | -.0784     | -.0829     |
| .802  | -.1665              | -.1548     | -.1571     | -.1504     | -.1489     |
| .822  | -.2506              | -.2407     | -.2552     | -.2368     | -.2268     |
| .851  | -.3853              | -.3813     | -.3845     | -.3688     | -.3660     |
| .861  | -.2483              | -.2359     | -.2432     | -.2393     | -.2244     |
| .881  | -.1762              | -.1643     | -.1762     | -.1672     | -.1632     |
| .921  | -.1257              | -.1166     | -.1235     | -.1241     | -.1159     |
| .960  | -.1232              | -.1095     | -.1163     | -.1168     | -.1041     |

TABLE I.- Continued

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.248$ (d)  $\alpha = 4^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | 1.0039              | .9058      | .9051      | .9942      | .9661      |
| .005  | .2066               | .2369      | .2514      | .2571      | .3697      |
| .010  | -.1922              | -.1706     | -.1564     | -.1139     | -.0033     |
| .020  | -.0979              | -.0723     | -.0744     | -.0436     | .0276      |
| .040  | .0495               | .0668      | .0655      | .0898      | .1274      |
| .060  | .0422               | .0620      | .0655      | .1019      | .1322      |
| .079  | .0688               | .0835      | .0776      | .1019      | .1345      |
| .099  | .0543               | .0739      | .0632      | .0825      | .1060      |
| .139  | .0229               | .0380      | .0318      | .0486      | .0680      |
| .179  | -.1318              | -.1059     | -.1178     | -.0678     | -.0414     |
| .198  | -.1849              | -.1634     | -.1781     | -.1550     | -.1530     |
| .208  | -.3348              | -.3145     | -.3300     | -.3151     | -.2813     |
| .227  | -.3348              | -.3168     | -.3493     | -.4411     | -.5308     |
| .237  | -.2091              | -.1874     | -.2046     | -.1648     | -.1459     |
| .257  | -.1172              | -.1011     | -.1178     | -.1041     | -.1007     |
| .276  | -.0762              | -.0651     | -.0888     | -.0823     | -.0793     |
| .302  | -.0786              | -.0627     | -.0864     | -.0945     | -.1055     |
| .311  | -.0617              | -.0507     | -.0671     | -.0630     | -.0722     |
| .331  | .0567               | .0787      | .0680      | .0995      | .1203      |
| .351  | .1123               | .1267      | .1210      | .1213      | .1322      |
| .371  | .1244               | .1410      | .1307      | .1262      | .1416      |
| .391  | .1461               | .1650      | .1524      | .1650      | .1750      |
| .412  | .1606               | .1770      | .1766      | .1722      | .1915      |
| .422  | .1291               | .1410      | .1331      | .1407      | .1535      |
| .442  | .0977               | .1123      | .0994      | .1068      | .1203      |
| .461  | .0833               | .0955      | .0752      | .0898      | .1060      |
| .481  | .0616               | .0691      | .0583      | .0680      | .0941      |
| .505  | .0446               | .0500      | .0390      | .0559      | .0727      |
| .525  | .0229               | .0451      | .0270      | .0486      | .0561      |
| .564  | -.0013              | .0211      | -.0019     | .0219      | .0419      |
| .604  | -.0303              | -.0147     | -.0358     | -.0097     | .0133      |
| .644  | -.0448              | -.0244     | -.0382     | -.0193     | .0062      |
| .683  | -.0690              | -.0507     | -.0671     | -.0387     | -.0270     |
| .723  | -.1028              | -.0843     | -.0937     | -.0726     | -.0627     |
| .763  | -.1318              | -.1083     | -.1298     | -.1090     | -.0888     |
| .802  | -.2067              | -.1850     | -.1997     | -.1818     | -.1625     |
| .822  | -.2816              | -.2545     | -.2818     | -.2666     | -.2528     |
| .851  | -.4049              | -.3792     | -.4048     | -.3927     | -.3834     |
| .861  | -.2671              | -.2450     | -.2673     | -.2569     | -.2480     |
| .881  | -.2019              | -.1730     | -.2022     | -.1914     | -.1743     |
| .921  | -.1487              | -.1226     | -.1443     | -.1405     | -.1269     |
| .960  | -.1463              | -.1203     | -.1395     | -.1356     | -.1150     |

TABLE I.- Concluded

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.248$ (e)  $\alpha = 8^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | .9769               | .9185      | .9314      | .9388      | .9191      |
| .005  | .0268               | .0504      | .0728      | .1596      | .3635      |
| .010  | -.3762              | -.3443     | -.3287     | -.2480     | -.0101     |
| .020  | -.2395              | -.1992     | -.1835     | -.1323     | .0136      |
| .040  | -.0050              | .0076      | .0003      | .0270      | .1034      |
| .060  | -.0050              | .0076      | -.0021     | .0367      | .1153      |
| .079  | .0121               | .0385      | .0245      | .0367      | .1129      |
| .099  | .0097               | .0266      | .0075      | .0246      | .0940      |
| .139  | -.0172              | -.0043     | -.0215     | -.0116     | .0467      |
| .179  | -.1613              | -.1446     | -.1666     | -.1178     | -.0715     |
| .198  | -.2199              | -.2017     | -.2174     | -.1611     | -.1424     |
| .208  | -.3665              | -.3349     | -.3697     | -.3349     | -.2795     |
| .227  | -.3371              | -.3134     | -.3673     | -.5857     | -.5301     |
| .237  | -.2199              | -.1992     | -.2174     | -.1611     | -.1401     |
| .257  | -.1271              | -.1018     | -.1206     | -.1178     | -.1141     |
| .276  | -.0782              | -.0543     | -.0868     | -.0888     | -.0904     |
| .302  | -.0782              | -.0495     | -.0820     | -.0840     | -.0975     |
| .311  | -.0490              | -.0352     | -.0626     | -.0598     | -.0762     |
| .331  | .0585               | .0789      | .0680      | .0704      | .0822      |
| .351  | .1074               | .1218      | .0946      | .0922      | .1058      |
| .371  | .1123               | .1265      | .0970      | .1041      | .1153      |
| .391  | .1318               | .1456      | .1284      | .1307      | .1460      |
| .412  | .1391               | .1479      | .1357      | .1355      | .1626      |
| .422  | .1098               | .1194      | .0946      | .1041      | .1177      |
| .442  | .0780               | .0885      | .0534      | .0704      | .0893      |
| .461  | .0585               | .0695      | .0438      | .0583      | .0798      |
| .481  | .0390               | .0433      | .0196      | .0439      | .0656      |
| .505  | .0145               | .0266      | -.0021     | .0174      | .0467      |
| .525  | -.0050              | .0076      | -.0118     | -.0044     | .0373      |
| .564  | -.0367              | -.0209     | -.0384     | -.0212     | .0207      |
| .604  | -.0587              | -.0495     | -.0650     | -.0502     | -.0101     |
| .644  | -.0734              | -.0637     | -.0820     | -.0671     | -.0266     |
| .683  | -.1027              | -.0851     | -.1062     | -.0888     | -.0479     |
| .723  | -.1320              | -.1113     | -.1351     | -.1105     | -.0739     |
| .763  | -.1515              | -.1422     | -.1738     | -.1443     | -.1117     |
| .802  | -.2199              | -.2040     | -.2367     | -.2118     | -.1826     |
| .822  | -.2932              | -.2825     | -.3045     | -.2915     | -.2654     |
| .851  | -.4153              | -.3824     | -.4109     | -.4097     | -.3978     |
| .861  | -.2736              | -.2634     | -.2875     | -.2794     | -.2583     |
| .881  | -.2101              | -.1874     | -.2150     | -.2071     | -.1920     |
| .921  | -.1564              | -.1375     | -.1691     | -.1419     | -.1377     |
| .960  | -.1564              | -.1350     | -.1617     | -.1443     | -.1282     |

TABLE II

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.395$ (a)  $\alpha = -8^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | .9526               | .9658      | .9801      | 1.0046     | 1.0230     |
| .005  | .7047               | .6969      | .6639      | .5833      | .3567      |
| .010  | .3327               | .3294      | .2859      | .1944      | -.0575     |
| .020  | .2311               | .2258      | .1863      | .1146      | -.0524     |
| .040  | .2779               | .2725      | .2463      | .1914      | .0726      |
| .060  | .2565               | .2522      | .2259      | .1681      | .0586      |
| .079  | .2534               | .2563      | .2299      | .1783      | .0716      |
| .099  | .2332               | .2400      | .2148      | .1671      | .0586      |
| .139  | .1935               | .1944      | .1731      | .1288      | .0245      |
| .179  | .0198               | .0431      | .0287      | -.0097     | -.1055     |
| .198  | -.0433              | -.0401     | -.0597     | -.1037     | -.1886     |
| .208  | -.2109              | -.2086     | -.2222     | -.2582     | -.3396     |
| .227  | -.2790              | -.2523     | -.1756     | -.2239     | -.3796     |
| .237  | -.1704              | -.1589     | -.1623     | -.1815     | -.2126     |
| .257  | -.1022              | -.1000     | -.1044     | -.1279     | -.1585     |
| .276  | -.0982              | -.0939     | -.1023     | -.1148     | -.1265     |
| .302  | -.1936              | -.1904     | -.1907     | -.1764     | -.1335     |
| .311  | -.1276              | -.1325     | -.1420     | -.1552     | -.1225     |
| .331  | .2596               | .2603      | .2361      | .1853      | .0606      |
| .351  | .1864               | .1852      | .1741      | .1489      | .0966      |
| .371  | .1884               | .1852      | .1720      | .1428      | .1016      |
| .391  | .2413               | .2411      | .2259      | .1933      | .1406      |
| .412  | .2758               | .2746      | .2584      | .2237      | .1566      |
| .422  | .2372               | .2319      | .2117      | .1792      | .1146      |
| .442  | .2047               | .2014      | .1852      | .1489      | .0846      |
| .461  | .1985               | .1944      | .1782      | .1428      | .0756      |
| .481  | .1803               | .1791      | .1588      | .1237      | .0486      |
| .505  | .1712               | .1700      | .1487      | .1136      | .0345      |
| .525  | .1549               | .1568      | .1355      | .0984      | .0196      |
| .564  | .1325               | .1304      | .1132      | .0711      | -.0015     |
| .604  | .0980               | .0959      | .0816      | .0378      | -.0374     |
| .644  | .0888               | .0857      | .0714      | .0368      | -.0385     |
| .683  | .0634               | .0614      | .0461      | .0105      | -.0645     |
| .723  | .0279               | .0258      | .0084      | -.0259     | -.1005     |
| .763  | -.0118              | -.0158     | -.0353     | -.0643     | -.1335     |
| .802  | -.1002              | -.0990     | -.1115     | -.1472     | -.2115     |
| .822  | -.1977              | -.1934     | -.2060     | -.2330     | -.2915     |
| .851  | -.3604              | -.3630     | -.3707     | -.3967     | -.4376     |
| .861  | -.2364              | -.2391     | -.2487     | -.2734     | -.3136     |
| .881  | -.1753              | -.1762     | -.1847     | -.2117     | -.2445     |
| .921  | -.1306              | -.1335     | -.1410     | -.1633     | -.1905     |
| .960  | -.1388              | -.1427     | -.1491     | -.1663     | -.1855     |

TABLE II.- Continued

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.395$ (b)  $\alpha = -4^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | 1.0013              | 1.0028     | .9974      | 1.0289     | 1.0370     |
| .005  | .5654               | .5626      | .5430      | .5030      | .3831      |
| .010  | .1653               | .1659      | .1413      | .0993      | -.0395     |
| .020  | .1164               | .1186      | .0946      | .0680      | -.0235     |
| .040  | .1969               | .2001      | .1839      | .1680      | .1026      |
| .060  | .1837               | .1901      | .1697      | .1538      | .0957      |
| .079  | .1816               | .1901      | .1798      | .1598      | .1047      |
| .099  | .1633               | .1719      | .1616      | .1478      | .0866      |
| .139  | .1246               | .1357      | .1180      | .1064      | .0526      |
| .179  | -.0495              | -.0425     | -.0433     | -.0319     | -.0806     |
| .198  | -.1076              | -.0980     | -.1153     | -.1278     | -.1797     |
| .208  | -.2777              | -.2702     | -.2827     | -.2853     | -.3279     |
| .227  | -.3255              | -.3175     | -.3181     | -.2853     | -.3990     |
| .237  | -.2095              | -.1967     | -.2035     | -.1832     | -.2007     |
| .257  | -.1259              | -.1191     | -.1275     | -.1238     | -.1416     |
| .276  | -.1076              | -.0980     | -.1082     | -.1036     | -.1126     |
| .302  | -.1626              | -.1503     | -.1589     | -.1419     | -.1267     |
| .311  | -.1361              | -.1281     | -.1376     | -.1308     | -.1156     |
| .331  | .1846               | .1941      | .1727      | .1568      | .0967      |
| .351  | .1704               | .1800      | .1676      | .1639      | .1307      |
| .371  | .1684               | .1790      | .1627      | .1619      | .1337      |
| .391  | .2152               | .2222      | .2103      | .2043      | .1758      |
| .412  | .2417               | .2485      | .2357      | .2306      | .1958      |
| .422  | .1990               | .2052      | .1900      | .1871      | .1567      |
| .442  | .1622               | .1740      | .1595      | .1538      | .1167      |
| .461  | .1531               | .1639      | .1494      | .1427      | .1017      |
| .481  | .1337               | .1437      | .1281      | .1185      | .0766      |
| .505  | .1225               | .1276      | .1149      | .1064      | .0626      |
| .525  | .1052               | .1115      | .0967      | .0933      | .0496      |
| .564  | .0859               | .0884      | .0744      | .0660      | .0196      |
| .604  | .0451               | .0592      | .0389      | .0347      | -.0105     |
| .644  | .0381               | .0471      | .0317      | .0236      | -.0194     |
| .683  | .0126               | .0229      | .0084      | .0024      | -.0435     |
| .723  | -.0210              | -.0124     | -.0311     | -.0349     | -.0785     |
| .763  | -.0588              | -.0546     | -.0667     | -.0712     | -.1136     |
| .802  | -.1422              | -.1352     | -.1508     | -.1551     | -.1927     |
| .822  | -.2359              | -.2228     | -.2411     | -.2428     | -.2799     |
| .851  | -.3906              | -.3829     | -.3983     | -.3983     | -.4231     |
| .861  | -.2685              | -.2520     | -.2695     | -.2751     | -.3019     |
| .881  | -.1961              | -.1855     | -.2025     | -.2055     | -.2297     |
| .921  | -.1432              | -.1322     | -.1498     | -.1510     | -.1747     |
| .960  | -.1341              | -.1262     | -.1416     | -.1439     | -.1627     |

TABLE II.- Continued  
PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.395$

(c)  $\alpha = 0^\circ$

| $x/\ell$ | $C_p$ at $\phi$ of: |            |            |            |            |
|----------|---------------------|------------|------------|------------|------------|
|          | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000     | 1.0044              | .9946      | .9975      | 1.0320     | 1.0330     |
| .005     | .3998               | .3962      | .4002      | .4024      | .3928      |
| .010     | -.0250              | -.0245     | -.0290     | -.0157     | -.0266     |
| .020     | -.0017              | -.0024     | -.0047     | .0045      | -.0015     |
| .040     | .1152               | .1147      | .1168      | .1233      | .1199      |
| .060     | .0939               | .0925      | .0905      | .0992      | .0988      |
| .079     | .1193               | .1167      | .1147      | .1233      | .1199      |
| .099     | .1020               | .1016      | .1026      | .1092      | .1039      |
| .139     | .0654               | .0673      | .0651      | .0709      | .0668      |
| .179     | -.1063              | -.1063     | -.1060     | -.0983     | -.0988     |
| .198     | -.1642              | -.1628     | -.1657     | -.1567     | -.1650     |
| .208     | -.3319              | -.3313     | -.3337     | -.3229     | -.3235     |
| .227     | -.3542              | -.3505     | -.3580     | -.3451     | -.3557     |
| .237     | -.2282              | -.2264     | -.2294     | -.2182     | -.2182     |
| .257     | -.1337              | -.1355     | -.1363     | -.1284     | -.1320     |
| .276     | -.1052              | -.1073     | -.1100     | -.1003     | -.0998     |
| .302     | -.1174              | -.1194     | -.1212     | -.1103     | -.1119     |
| .311     | -.1093              | -.1083     | -.1120     | -.1043     | -.1068     |
| .331     | .0899               | .0925      | .0884      | .1002      | .0979      |
| .351     | .1538               | .1551      | .1532      | .1596      | .1520      |
| .371     | .1610               | .1581      | .1603      | .1657      | .1620      |
| .391     | .1966               | .1984      | .1957      | .2019      | .1982      |
| .412     | .2168               | .2156      | .2190      | .2220      | .2203      |
| .422     | .1752               | .1742      | .1735      | .1848      | .1801      |
| .442     | .1376               | .1389      | .1360      | .1455      | .1440      |
| .461     | .1244               | .1207      | .1219      | .1294      | .1219      |
| .481     | .1031               | .1006      | .0976      | .1083      | .0988      |
| .505     | .0888               | .0844      | .0824      | .0921      | .0828      |
| .525     | .0705               | .0652      | .0631      | .0780      | .0707      |
| .564     | .0441               | .0431      | .0379      | .0488      | .0396      |
| .604     | .0085               | .0098      | .0075      | .0135      | .0115      |
| .644     | -.0017              | -.0044     | -.0068     | .0055      | -.0005     |
| .683     | -.0260              | -.0327     | -.0301     | -.0197     | -.0296     |
| .723     | -.0616              | -.0629     | -.0654     | -.0549     | -.0647     |
| .763     | -.0971              | -.1003     | -.1029     | -.0902     | -.0968     |
| .802     | -.1794              | -.1810     | -.1819     | -.1718     | -.1771     |
| .822     | -.2679              | -.2707     | -.2739     | -.2604     | -.2654     |
| .851     | -.4091              | -.4110     | -.4157     | -.4045     | -.4068     |
| .861     | -.2852              | -.2849     | -.2882     | -.2796     | -.2814     |
| .881     | -.2100              | -.2102     | -.2163     | -.2090     | -.2112     |
| .921     | -.1591              | -.1557     | -.1636     | -.1527     | -.1590     |
| .960     | -.1510              | -.1497     | -.1545     | -.1456     | -.1450     |

TABLE II.- Continued

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.395$ (d)  $\alpha = 4^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | 1.0340              | .9915      | .9903      | 1.0128     | 1.0000     |
| .005  | .2104               | .2199      | .2389      | .2694      | .3897      |
| .010  | -.2267              | -.2146     | -.1905     | -.1503     | -.0275     |
| .020  | -.1374              | -.1267     | -.1084     | -.0805     | -.0015     |
| .040  | .0370               | .0431      | .0491      | .0661      | .1156      |
| .060  | .0208               | .0309      | .0359      | .0448      | .1166      |
| .079  | .0482               | .0572      | .0581      | .0702      | .1176      |
| .099  | .0381               | .0431      | .0430      | .0520      | .1006      |
| .139  | .0066               | .0098      | .0054      | .0135      | .0586      |
| .179  | -.1587              | -.1539     | -.1581     | -.1392     | -.1045     |
| .198  | -.2146              | -.2105     | -.2150     | -.2039     | -.1645     |
| .208  | -.3788              | -.3751     | -.3764     | -.3647     | -.3226     |
| .227  | -.3747              | -.3721     | -.3774     | -.3667     | -.3436     |
| .237  | -.2449              | -.2358     | -.2485     | -.2393     | -.2185     |
| .257  | -.1414              | -.1387     | -.1449     | -.1402     | -.1295     |
| .276  | -.0999              | -.1014     | -.1114     | -.1058     | -.1065     |
| .302  | -.0928              | -.0933     | -.1052     | -.1089     | -.1355     |
| .311  | -.0837              | -.0842     | -.0941     | -.0896     | -.0805     |
| .331  | .0583               | .0662      | .0602      | .0773      | .1076      |
| .351  | .1282               | .1329      | .1242      | .1328      | .1406      |
| .371  | .1465               | .1502      | .1394      | .1471      | .1566      |
| .391  | .1749               | .1774      | .1719      | .1773      | .1917      |
| .412  | .1861               | .1895      | .1830      | .1884      | .2056      |
| .422  | .1526               | .1572      | .1465      | .1511      | .1707      |
| .442  | .1141               | .1168      | .1059      | .1146      | .1226      |
| .461  | .0938               | .0945      | .0896      | .0974      | .1156      |
| .481  | .0674               | .0703      | .0643      | .0773      | .0946      |
| .505  | .0512               | .0512      | .0450      | .0550      | .0756      |
| .525  | .0319               | .0319      | .0246      | .0409      | .0635      |
| .564  | .0066               | .0077      | .0014      | .0135      | .0386      |
| .604  | -.0340              | -.0246     | -.0332     | -.0199     | .0085      |
| .644  | -.0441              | -.0408     | -.0453     | -.0300     | -.0054     |
| .683  | -.0695              | -.0660     | -.0687     | -.0552     | -.0294     |
| .723  | -.1009              | -.0984     | -.1073     | -.0886     | -.0615     |
| .763  | -.1374              | -.1306     | -.1429     | -.1250     | -.0955     |
| .802  | -.2165              | -.2105     | -.2201     | -.2049     | -.1775     |
| .822  | -.3017              | -.2933     | -.3053     | -.2888     | -.2726     |
| .851  | -.4274              | -.4185     | -.4301     | -.4153     | -.4076     |
| .861  | -.3038              | -.2953     | -.3073     | -.2980     | -.2826     |
| .881  | -.2328              | -.2256     | -.2342     | -.2231     | -.2085     |
| .921  | -.1740              | -.1690     | -.1835     | -.1685     | -.1595     |
| .960  | -.1709              | -.1660     | -.1723     | -.1624     | -.1496     |

TABLE II.- Concluded  
PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.395$

(e)  $\alpha = 8^\circ$

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | .9935               | .9967      | .9871      | .9662      | .9416      |
| .005  | .0128               | .0280      | .0501      | .1308      | .3581      |
| .010  | -.4185              | -.3926     | -.3755     | -.3010     | -.0508     |
| .020  | -.2701              | -.2557     | -.2502     | -.1725     | -.0196     |
| .040  | -.0277              | -.0163     | -.0262     | -.0148     | .0758      |
| .060  | -.0317              | -.0163     | -.0313     | -.0148     | .0808      |
| .079  | -.0024              | .0078      | -.0038     | .0084      | .0838      |
| .099  | -.0125              | -.0022     | -.0181     | -.0138     | .0648      |
| .139  | -.0427              | -.0364     | -.0527     | -.0471     | .0196      |
| .179  | -.1964              | -.1883     | -.2054     | -.2029     | -.1241     |
| .198  | -.2499              | -.2447     | -.2594     | -.2575     | -.1974     |
| .208  | -.4075              | -.4006     | -.4204     | -.4133     | -.3520     |
| .227  | -.3762              | -.3724     | -.3979     | -.4011     | -.3701     |
| .237  | -.2448              | -.2376     | -.2635     | -.2697     | -.2244     |
| .257  | -.1368              | -.1341     | -.1535     | -.1635     | -.1532     |
| .276  | -.0922              | -.0878     | -.1118     | -.1240     | -.1260     |
| .302  | -.0751              | -.0766     | -.0976     | -.1058     | -.1341     |
| .311  | -.0680              | -.0646     | -.0812     | -.0886     | -.0969     |
| .331  | .0582               | .0642      | .0512      | .0398      | .0628      |
| .351  | .1208               | .1266      | .1062      | .0925      | .0980      |
| .371  | .1410               | .1447      | .1215      | .1086      | .1090      |
| .391  | .1633               | .1668      | .1479      | .1369      | .1511      |
| .412  | .1723               | .1738      | .1489      | .1450      | .1592      |
| .422  | .1380               | .1396      | .1174      | .1056      | .1190      |
| .442  | .0986               | .1034      | .0786      | .0681      | .0799      |
| .461  | .0754               | .0792      | .0563      | .0499      | .0728      |
| .481  | .0482               | .0521      | .0257      | .0266      | .0547      |
| .505  | .0259               | .0300      | .0074      | .0064      | .0387      |
| .525  | .0098               | .0129      | -.0130     | -.0098     | .0216      |
| .564  | -.0196              | -.0144     | -.0364     | -.0360     | -.0005     |
| .604  | -.0549              | -.0505     | -.0731     | -.0664     | -.0307     |
| .644  | -.0671              | -.0646     | -.0853     | -.0796     | -.0437     |
| .683  | -.0903              | -.0878     | -.1057     | -.1028     | -.0658     |
| .723  | -.1236              | -.1229     | -.1433     | -.1321     | -.1010     |
| .763  | -.1580              | -.1522     | -.1760     | -.1685     | -.1301     |
| .802  | -.2277              | -.2256     | -.2482     | -.2423     | -.2095     |
| .822  | -.3054              | -.3020     | -.3307     | -.3324     | -.3059     |
| .851  | -.4216              | -.4107     | -.4346     | -.4456     | -.4364     |
| .861  | -.2984              | -.2960     | -.3175     | -.3213     | -.3139     |
| .881  | -.2246              | -.2236     | -.2462     | -.2494     | -.2386     |
| .921  | -.1721              | -.1683     | -.1912     | -.1918     | -.1843     |
| .960  | -.1721              | -.1692     | -.1861     | -.1817     | -.1752     |

TABLE III

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.585$ (a)  $\alpha = -8^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | 1.0069              | 1.0154     | 1.0317     | 1.0481     | 1.0746     |
| .005  | .7198               | .7354      | .7074      | .6235      | .4036      |
| .010  | .3100               | .3499      | .3216      | .2192      | -.0294     |
| .020  | .2171               | .2382      | .2128      | .1309      | -.0377     |
| .040  | .2782               | .2935      | .2803      | .2161      | .0986      |
| .060  | .2412               | .2596      | .2443      | .1839      | .0698      |
| .079  | .2618               | .2826      | .2618      | .2026      | .0960      |
| .099  | .2402               | .2548      | .2458      | .1875      | .0817      |
| .139  | .1986               | .2152      | .2051      | .1522      | .0564      |
| .179  | .0241               | .0287      | .0482      | -.0014     | -.1327     |
| .198  | -.0550              | -.0293     | -.0383     | -.0881     | -.1693     |
| .208  | -.2363              | -.2084     | -.2127     | -.2568     | -.3467     |
| .227  | -.3128              | -.2966     | -.2606     | -.2412     | -.3858     |
| .237  | -.1860              | -.1703     | -.1637     | -.1804     | -.2470     |
| .257  | -.1028              | -.0940     | -.0915     | -.1208     | -.1544     |
| .276  | -.0962              | -.0878     | -.0817     | -.1047     | -.1184     |
| .302  | -.1696              | -.1724     | -.1539     | -.1540     | -.1106     |
| .311  | -.1382              | -.1442     | -.1354     | -.1457     | -.1014     |
| .331  | .2480               | .2742      | .2499      | .1849      | .0600      |
| .351  | .2207               | .2293      | .2247      | .1885      | .1253      |
| .371  | .2217               | .2225      | .2175      | .1823      | .1382      |
| .391  | .2731               | .2841      | .2721      | .2342      | .1799      |
| .412  | .3091               | .3176      | .2942      | .2643      | .1989      |
| .422  | .2684               | .2695      | .2597      | .2170      | .1521      |
| .442  | .2340               | .2507      | .2283      | .1870      | .1197      |
| .461  | .2248               | .2298      | .2200      | .1772      | .1038      |
| .481  | .1992               | .2120      | .2045      | .1549      | .0827      |
| .505  | .1879               | .2010      | .1911      | .1449      | .0683      |
| .525  | .1755               | .1844      | .1767      | .1309      | .0534      |
| .564  | .1489               | .1619      | .1515      | .1040      | .0241      |
| .604  | .1124               | .1269      | .1168      | .0697      | -.0094     |
| .644  | .1020               | .1186      | .1117      | .0656      | -.0124     |
| .683  | .0744               | .0908      | .0844      | .0359      | -.0387     |
| .723  | .0415               | .0527      | .0452      | -.0003     | -.0768     |
| .763  | .0029               | .0125      | .0060      | -.0382     | -.1117     |
| .802  | -.0981              | -.0779     | -.0807     | -.1270     | -.1945     |
| .822  | -.2004              | -.1786     | -.1776     | -.2219     | -.2814     |
| .851  | -.3914              | -.3730     | -.3679     | -.4073     | -.4495     |
| .861  | -.2589              | -.2445     | -.2410     | -.2812     | -.3205     |
| .881  | -.1845              | -.1713     | -.1693     | -.2059     | -.2398     |
| .921  | -.1325              | -.1222     | -.1194     | -.1545     | -.1816     |
| .960  | -.1321              | -.1311     | -.1203     | -.1571     | -.1771     |

TABLE III.- Continued

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.585$ (b)  $\alpha = -4^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | 1.0514              | 1.0588     | 1.0631     | 1.0766     | 1.0824     |
| .005  | .6220               | .5994      | .5826      | .5467      | .4235      |
| .010  | .2117               | .1834      | .1675      | .1245      | -.0163     |
| .020  | .1436               | .1289      | .1121      | .0820      | -.0123     |
| .040  | .2251               | .2167      | .2099      | .1893      | .1238      |
| .060  | .1936               | .1830      | .1726      | .1706      | .1028      |
| .079  | .2168               | .2083      | .1974      | .1825      | .1192      |
| .099  | .1998               | .1918      | .1830      | .1691      | .1069      |
| .139  | .1555               | .1533      | .1467      | .1256      | .0752      |
| .179  | -.0301              | -.0294     | -.0402     | -.0246     | -.1043     |
| .198  | -.0898              | -.0907     | -.0966     | -.1142     | -.1595     |
| .208  | -.2765              | -.2736     | -.2799     | -.2899     | -.3381     |
| .227  | -.3455              | -.3338     | -.3353     | -.2987     | -.3698     |
| .237  | -.2110              | -.2018     | -.2048     | -.1925     | -.2312     |
| .257  | -.1228              | -.1136     | -.1131     | -.1168     | -.1350     |
| .276  | -.1059              | -.0939     | -.0934     | -.0977     | -.1023     |
| .302  | -.1533              | -.1301     | -.1267     | -.1257     | -.1007     |
| .311  | -.1398              | -.1239     | -.1204     | -.1174     | -.0941     |
| .331  | .1720               | .1663      | .1581      | .1515      | .0839      |
| .351  | .2096               | .2171      | .2119      | .1991      | .1642      |
| .371  | .2085               | .2156      | .2109      | .2011      | .1765      |
| .391  | .2575               | .2603      | .2565      | .2442      | .2113      |
| .412  | .2911               | .2904      | .2818      | .2701      | .2353      |
| .422  | .2411               | .2426      | .2384      | .2214      | .1944      |
| .442  | .2049               | .2068      | .2032      | .1904      | .1545      |
| .461  | .1926               | .1944      | .1886      | .1769      | .1376      |
| .481  | .1746               | .1715      | .1669      | .1545      | .1085      |
| .505  | .1580               | .1586      | .1529      | .1359      | .0937      |
| .525  | .1442               | .1419      | .1338      | .1214      | .0783      |
| .564  | .1189               | .1170      | .1110      | .0893      | .0512      |
| .604  | .0823               | .0827      | .0743      | .0634      | .0174      |
| .644  | .0699               | .0718      | .0675      | .0546      | .0097      |
| .683  | .0426               | .0438      | .0412      | .0235      | -.0189     |
| .723  | .0060               | .0079      | .0038      | -.0107     | -.0522     |
| .763  | -.0368              | -.0316     | -.0355     | -.0485     | -.0874     |
| .802  | -.1249              | -.1198     | -.1251     | -.1392     | -.1760     |
| .822  | -.2265              | -.2190     | -.2208     | -.2334     | -.2670     |
| .851  | -.4115              | -.3976     | -.4021     | -.4116     | -.4347     |
| .861  | -.2801              | -.2678     | -.2716     | -.2811     | -.3038     |
| .881  | -.1986              | -.1888     | -.1934     | -.2023     | -.2235     |
| .921  | -.1419              | -.1292     | -.1329     | -.1437     | -.1627     |
| .960  | -.1347              | -.1198     | -.1235     | -.1371     | -.1534     |

TABLE III.- Continued

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.585$ (c)  $\alpha = 0^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | 1.0568              | 1.0594     | 1.0616     | 1.0813     | 1.0793     |
| .005  | .4915               | .4319      | .4365      | .4404      | .4376      |
| .010  | .0701               | -.0124     | -.0065     | -.0019     | -.0047     |
| .020  | .0512               | .0016      | .0048      | .0095      | .0076      |
| .040  | .1644               | .1354      | .1412      | .1422      | .1416      |
| .060  | .1379               | .1119      | .1153      | .1184      | .1174      |
| .079  | .1608               | .1365      | .1403      | .1437      | .1420      |
| .099  | .1445               | .1213      | .1257      | .1277      | .1261      |
| .139  | .1061               | .0833      | .0858      | .0919      | .0882      |
| .179  | -.0784              | -.0946     | -.0927     | -.0890     | -.0893     |
| .198  | -.1333              | -.1565     | -.1539     | -.1533     | -.1525     |
| .208  | -.3229              | -.3397     | -.3354     | -.3316     | -.3309     |
| .227  | -.3675              | -.3713     | -.3671     | -.3622     | -.3612     |
| .237  | -.2271              | -.2299     | -.2260     | -.2212     | -.2206     |
| .257  | -.1323              | -.1278     | -.1244     | -.1237     | -.1211     |
| .276  | -.1036              | -.0956     | -.0938     | -.0931     | -.0893     |
| .302  | -.1195              | -.0988     | -.0947     | -.0947     | -.0908     |
| .311  | -.1128              | -.0930     | -.0917     | -.0895     | -.0853     |
| .331  | .1086               | .0901      | .0883      | .0945      | .0922      |
| .351  | .1865               | .1796      | .1801      | .1827      | .1810      |
| .371  | .2004               | .1998      | .2004      | .2019      | .2016      |
| .391  | .2428               | .2363      | .2372      | .2408      | .2385      |
| .412  | .2634               | .2560      | .2569      | .2589      | .2601      |
| .422  | .2188               | .2155      | .2175      | .2195      | .2190      |
| .442  | .1794               | .1754      | .1755      | .1781      | .1800      |
| .461  | .1665               | .1556      | .1579      | .1614      | .1594      |
| .481  | .1466               | .1318      | .1319      | .1355      | .1318      |
| .505  | .1281               | .1151      | .1138      | .1199      | .1133      |
| .525  | .1091               | .0964      | .0967      | .0930      | .1045      |
| .564  | .0856               | .0698      | .0707      | .0722      | .0712      |
| .604  | .0481               | .0339      | .0350      | .0386      | .0358      |
| .644  | .0374               | .0215      | .0235      | .0277      | .0277      |
| .683  | .0091               | -.0046     | -.0035     | -.0009     | -.0005     |
| .723  | -.0282              | -.0405     | -.0388     | -.0341     | -.0344     |
| .763  | -.0682              | -.0785     | -.0776     | -.0755     | -.0713     |
| .802  | -.1528              | -.1679     | -.1648     | -.1626     | -.1627     |
| .822  | -.2543              | -.2642     | -.2623     | -.2596     | -.2581     |
| .851  | -.4234              | -.4255     | -.4226     | -.4193     | -.4182     |
| .861  | -.2932              | -.2928     | -.2935     | -.2912     | -.2909     |
| .881  | -.2096              | -.2132     | -.2100     | -.2078     | -.2063     |
| .921  | -.1471              | -.1477     | -.1467     | -.1455     | -.1483     |
| .960  | -.1384              | -.1383     | -.1336     | -.1357     | -.1349     |

TABLE III.- Continued

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.585$ (d)  $\alpha = 4^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | 1.0869              | 1.0568     | 1.0599     | 1.0625     | 1.0551     |
| .005  | .2830               | .2483      | .2718      | .3140      | .4348      |
| .010  | -.1602              | -.2075     | -.1863     | -.1373     | -.0062     |
| .020  | -.1024              | -.1284     | -.1162     | -.0756     | .0127      |
| .040  | .0705               | .0595      | .0676      | .0832      | .1381      |
| .060  | .0555               | .0458      | .0562      | .0712      | .1139      |
| .079  | .0808               | .0730      | .0791      | .0900      | .1385      |
| .099  | .0669               | .0584      | .0640      | .0764      | .1180      |
| .139  | .0313               | .0215      | .0256      | .0375      | .0816      |
| .179  | -.1483              | -.1497     | -.1437     | -.1321     | -.0945     |
| .198  | -.2045              | -.2121     | -.2071     | -.1949     | -.1567     |
| .208  | -.3888              | -.3917     | -.3864     | -.3739     | -.3375     |
| .227  | -.3965              | -.3895     | -.3875     | -.3847     | -.3657     |
| .237  | -.2515              | -.2428     | -.2440     | -.2389     | -.2255     |
| .257  | -.1416              | -.1321     | -.1323     | -.1306     | -.1249     |
| .276  | -.1018              | -.0900     | -.0929     | -.0947     | -.0956     |
| .302  | -.0879              | -.0754     | -.0783     | -.0859     | -.1013     |
| .311  | -.0843              | -.0686     | -.0706     | -.0720     | -.0781     |
| .331  | .0612               | .0672      | .0702      | .0827      | .1020      |
| .351  | .1530               | .1530      | .1518      | .1537      | .1724      |
| .371  | .1783               | .1816      | .1783      | .1786      | .1956      |
| .391  | .2150               | .2118      | .2110      | .2150      | .2330      |
| .412  | .2268               | .2259      | .2225      | .2274      | .2505      |
| .422  | .1901               | .1900      | .1908      | .1916      | .2089      |
| .442  | .1505               | .1489      | .1461      | .1485      | .1657      |
| .461  | .1272               | .1265      | .1263      | .1298      | .1493      |
| .481  | .1019               | .0974      | .0978      | .1035      | .1277      |
| .505  | .0818               | .0776      | .0785      | .0853      | .1067      |
| .525  | .0617               | .0589      | .0594      | .0656      | .0918      |
| .564  | .0333               | .0292      | .0297      | .0365      | .0677      |
| .604  | -.0053              | -.0057     | -.0076     | .0044      | .0328      |
| .644  | -.0162              | -.0212     | -.0175     | -.0071     | .0194      |
| .683  | -.0451              | -.0473     | -.0461     | -.0371     | -.0062     |
| .723  | -.0802              | -.0821     | -.0788     | -.0724     | -.0391     |
| .763  | -.1220              | -.1190     | -.1167     | -.1077     | -.0781     |
| .802  | -.2020              | -.2044     | -.2024     | -.1938     | -.1639     |
| .822  | -.3005              | -.2954     | -.2960     | -.2903     | -.2645     |
| .851  | -.4465              | -.4343     | -.4342     | -.4335     | -.4196     |
| .861  | -.3191              | -.3099     | -.3106     | -.3080     | -.2917     |
| .881  | -.2365              | -.2262     | -.2269     | -.2255     | -.2096     |
| .921  | -.1694              | -.1649     | -.1651     | -.1617     | -.1490     |
| .960  | -.1638              | -.1602     | -.1552     | -.1508     | -.1376     |

TABLE III.-- Concluded

PRESSURE COEFFICIENTS OVER SURFACE OF MODEL AT  $M = 0.585$ (e)  $\alpha = 8^\circ$ 

| $x/l$ | $C_p$ at $\phi$ of: |            |            |            |            |
|-------|---------------------|------------|------------|------------|------------|
|       | $0^\circ$           | $15^\circ$ | $30^\circ$ | $50^\circ$ | $90^\circ$ |
| .000  | 1.0610              | 1.0526     | 1.0384     | 1.0178     | .9934      |
| .005  | .0743               | .0568      | .1004      | .1769      | .4082      |
| .010  | -.3817              | -.4026     | -.3590     | -.2841     | -.0315     |
| .020  | -.2467              | -.2653     | -.2578     | -.1752     | -.0088     |
| .040  | -.0013              | -.0057     | .0045      | .0168      | .0934      |
| .060  | -.0081              | -.0108     | -.0023     | .0111      | .0821      |
| .079  | .0194               | .0173      | .0261      | .0359      | .0996      |
| .099  | .0070               | .0016      | .0107      | .0168      | .0775      |
| .139  | -.0297              | -.0347     | -.0255     | -.0209     | .0375      |
| .179  | -.1974              | -.1919     | -.1871     | -.1799     | -.1318     |
| .198  | -.2533              | -.2543     | -.2470     | -.2423     | -.1837     |
| .208  | -.4329              | -.4292     | -.4205     | -.4152     | -.3647     |
| .227  | -.4071              | -.3968     | -.3926     | -.4034     | -.3915     |
| .237  | -.2554              | -.2486     | -.2470     | -.2568     | -.2546     |
| .257  | -.1369              | -.1295     | -.1308     | -.1432     | -.1539     |
| .276  | -.0898              | -.0857     | -.0869     | -.1014     | -.1215     |
| .302  | -.0717              | -.0660     | -.0684     | -.0812     | -.1153     |
| .311  | -.0645              | -.0551     | -.0550     | -.0648     | -.0829     |
| .331  | .0619               | .0734      | .0742      | .0576      | .0498      |
| .351  | .1399               | .1436      | .1397      | .1196      | .1176      |
| .371  | .1684               | .1723      | .1650      | .1433      | .1408      |
| .391  | .1933               | .1968      | .1897      | .1753      | .1830      |
| .412  | .2031               | .2045      | .1949      | .1825      | .1928      |
| .422  | .1700               | .1717      | .1624      | .1490      | .1485      |
| .442  | .1275               | .1296      | .1206      | .1098      | .1130      |
| .461  | .1021               | .1015      | .0958      | .0860      | .0960      |
| .481  | .0737               | .0734      | .0674      | .0607      | .0800      |
| .505  | .0510               | .0485      | .0457      | .0401      | .0641      |
| .525  | .0292               | .0266      | .0256      | .0215      | .0467      |
| .564  | -.0013              | -.0040     | -.0017     | -.0053     | .0230      |
| .604  | -.0402              | -.0400     | -.0390     | -.0390     | -.0084     |
| .644  | -.0521              | -.0540     | -.0513     | -.0513     | -.0217     |
| .683  | -.0790              | -.0795     | -.0771     | -.0797     | -.0500     |
| .723  | -.1147              | -.1134     | -.1097     | -.1112     | -.0793     |
| .763  | -.1525              | -.1482     | -.1453     | -.1458     | -.1159     |
| .802  | -.2300              | -.2283     | -.2279     | -.2289     | -.2011     |
| .822  | -.3191              | -.3125     | -.3125     | -.3250     | -.3050     |
| .851  | -.4536              | -.4354     | -.4261     | -.4535     | -.4547     |
| .861  | -.3274              | -.3183     | -.3105     | -.3239     | -.3262     |
| .881  | -.2435              | -.2351     | -.2315     | -.2387     | -.2428     |
| .921  | -.1814              | -.1721     | -.1705     | -.1783     | -.1811     |
| .960  | -.1762              | -.1711     | -.1649     | -.1696     | -.1703     |

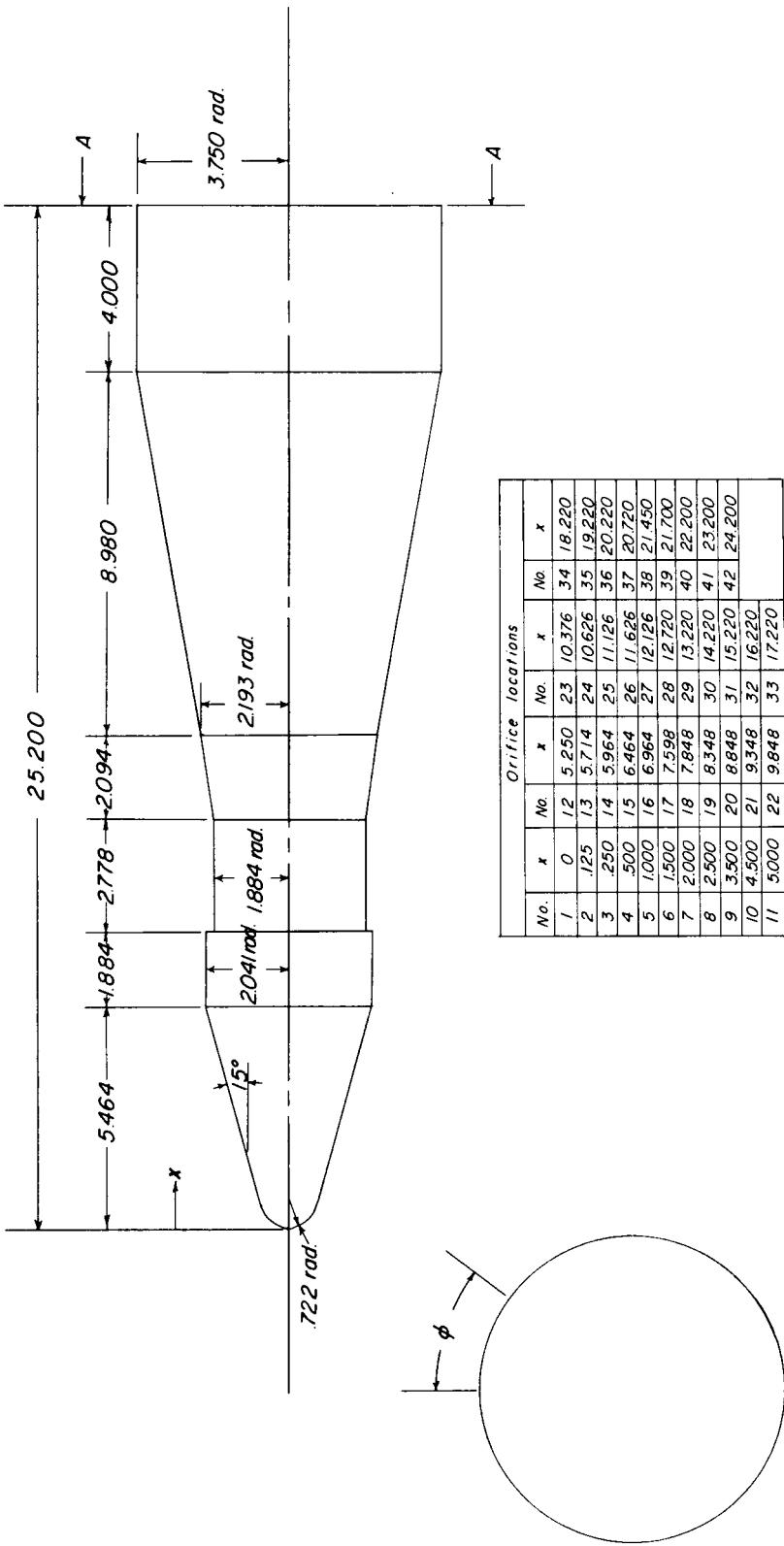


Figure 1.- Drawing of model. All dimensions in inches.

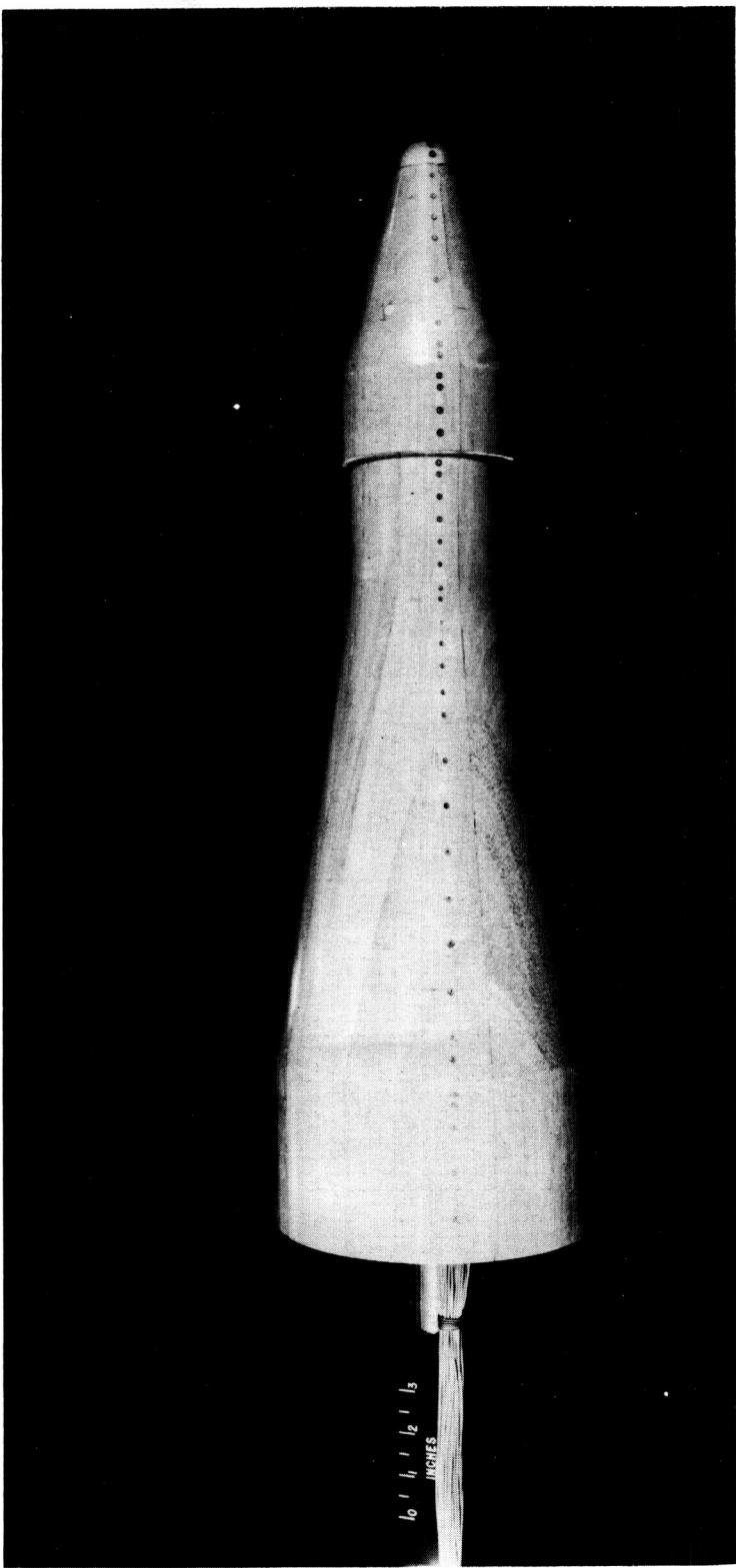


Figure 2.- Photograph of model.

L-62-4498

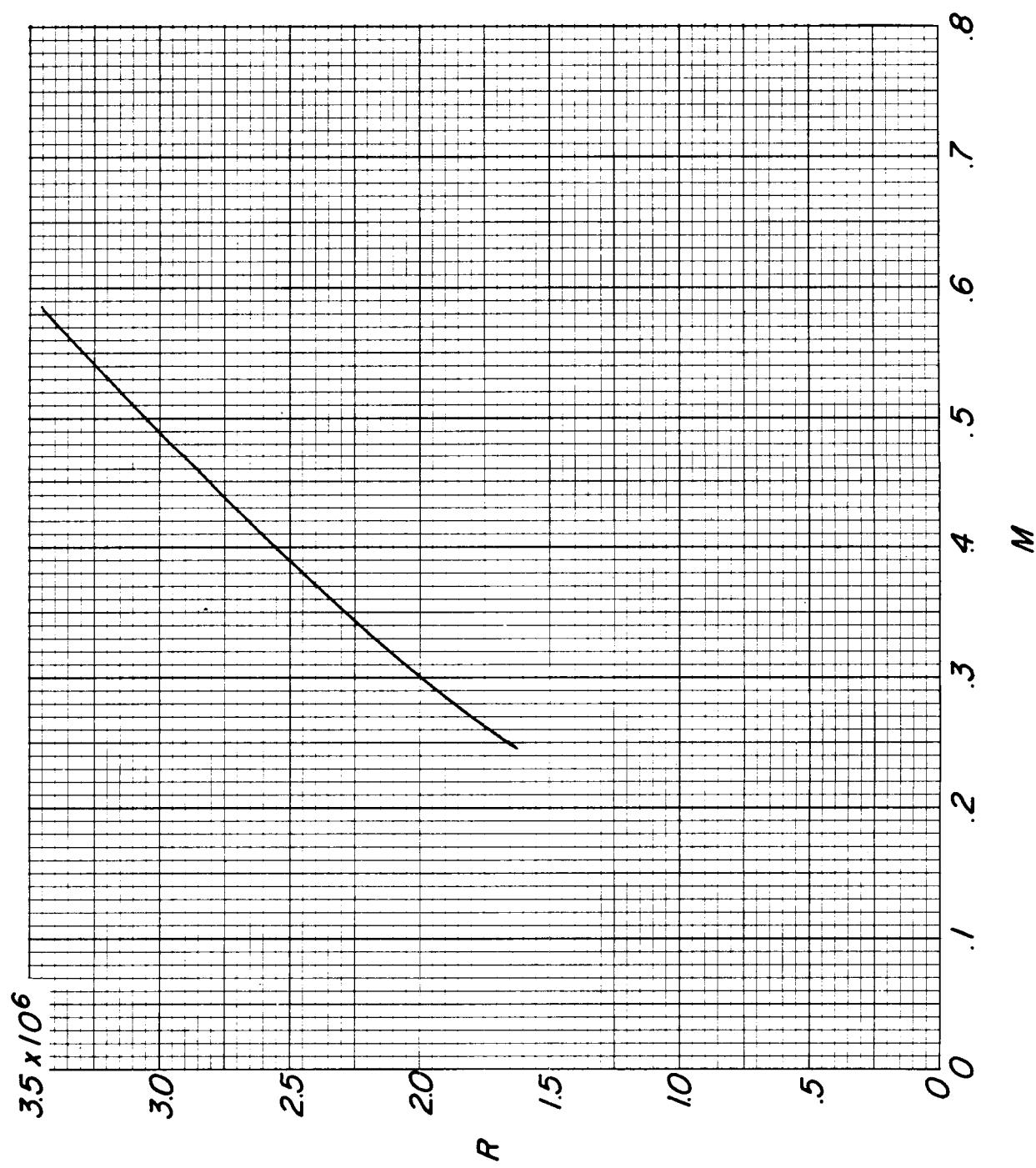


Figure 3.- Variation of Reynolds number with Mach number.

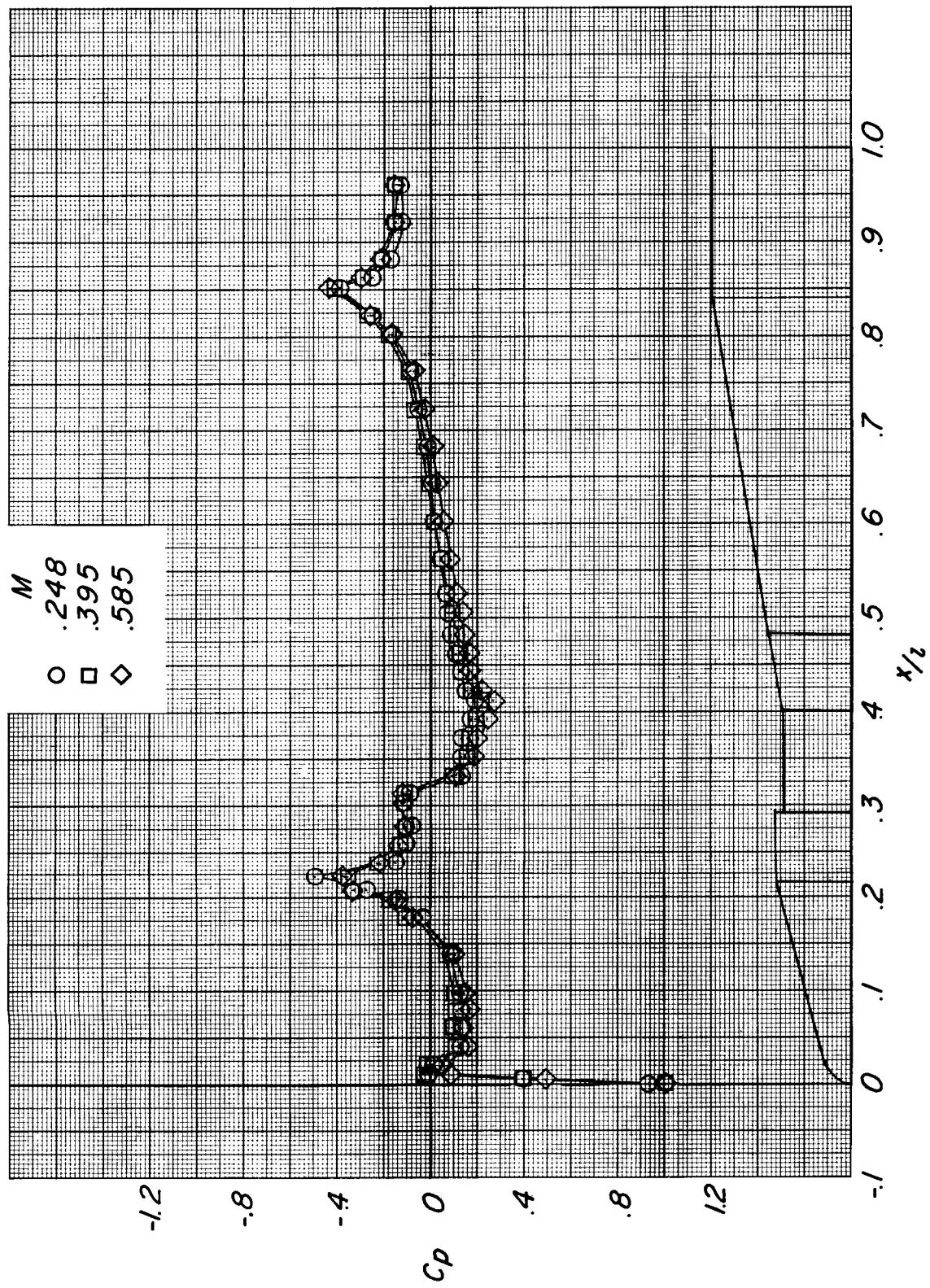


Figure 4.- Effect of Mach number and Reynolds number on pressure distribution over model.  $\alpha = 0^\circ$ ;  $\phi = 0^\circ$ .

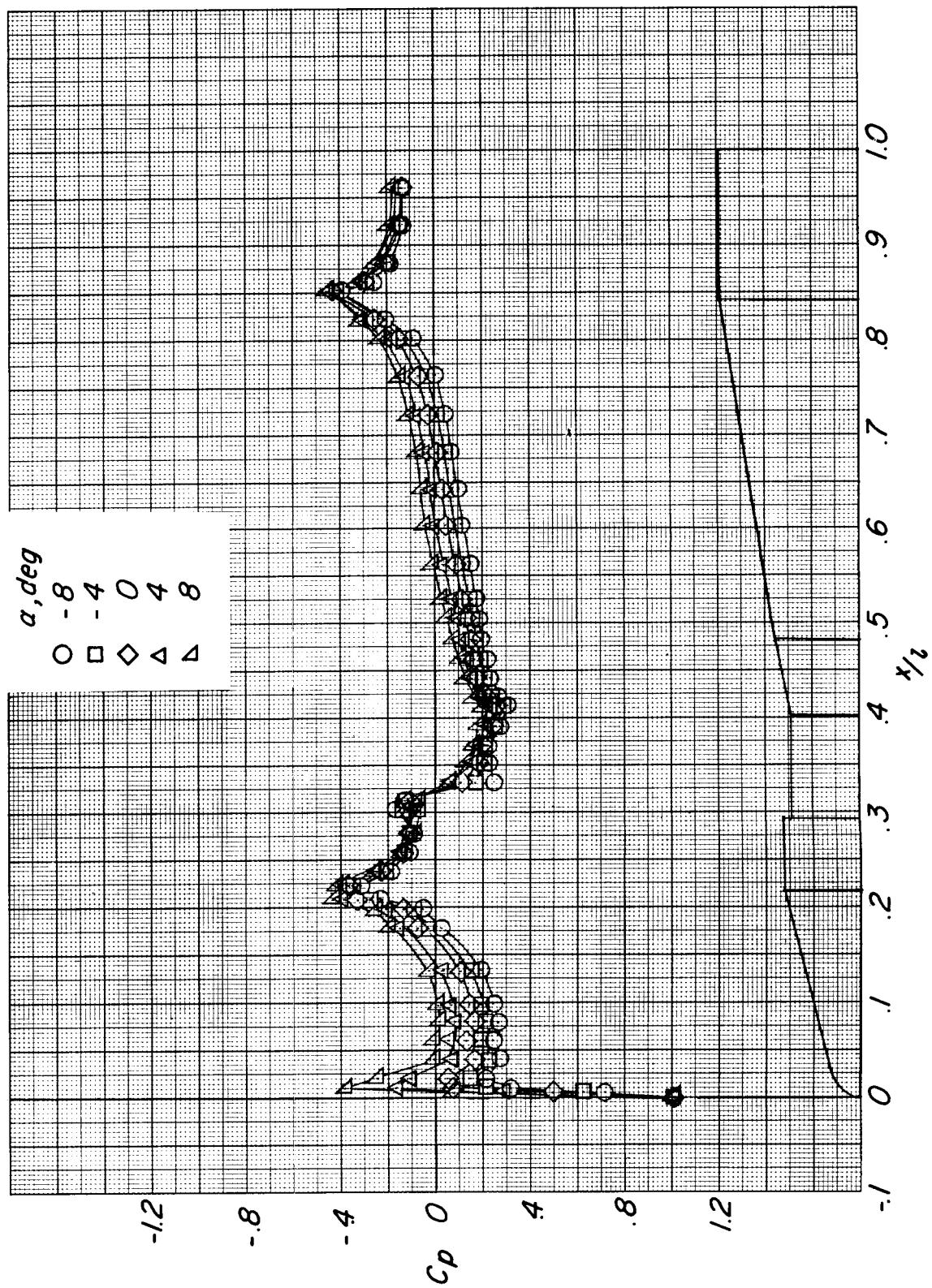


Figure 5.- Effect of angle of attack on pressure distribution over model.  $\phi = 0^\circ$ ;  $M = 0.585$ .

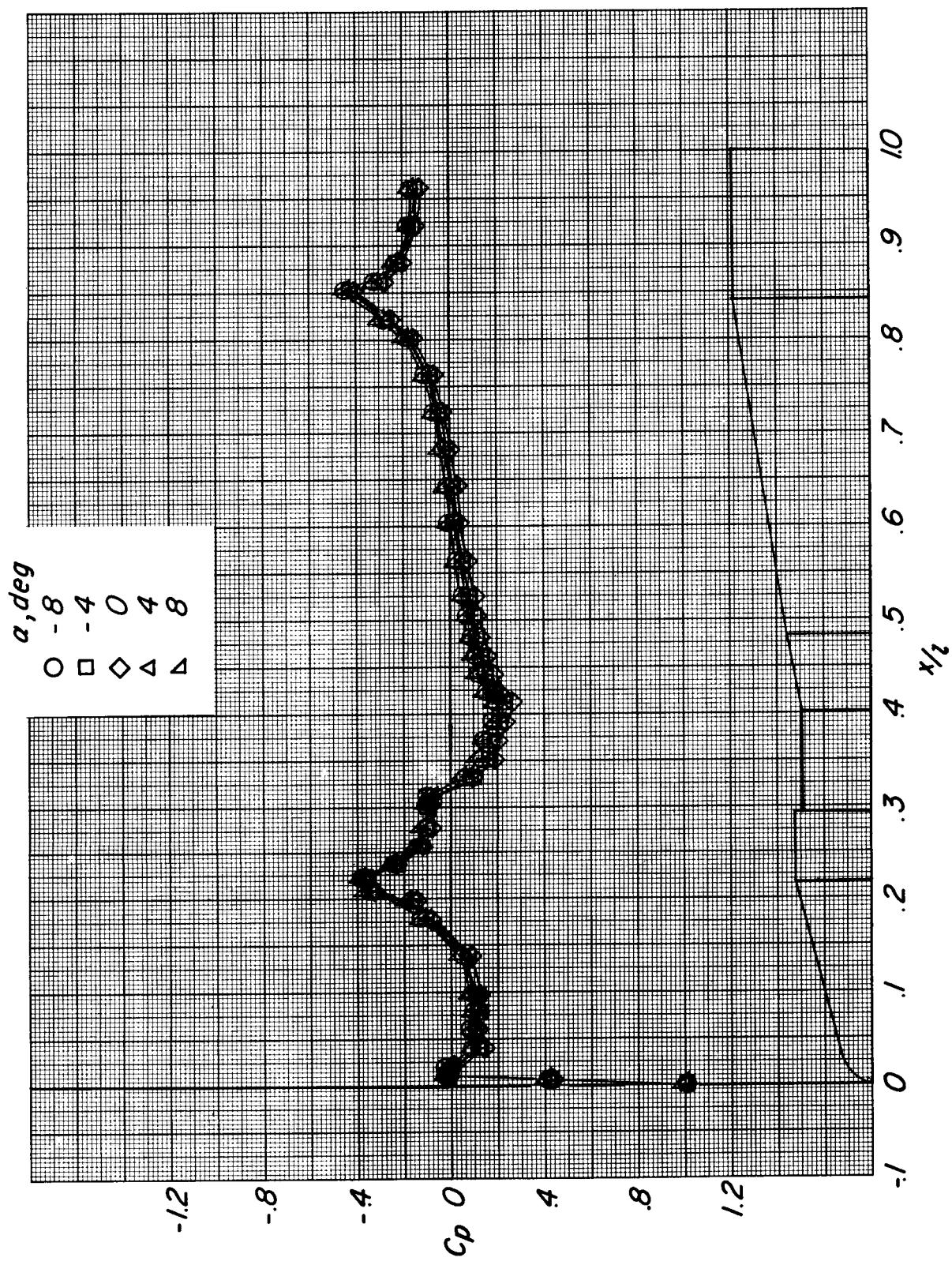


Figure 6.- Effect of angle of attack on pressure distribution over model.  $\phi = 90^\circ$ ;  $M = 0.585$ .

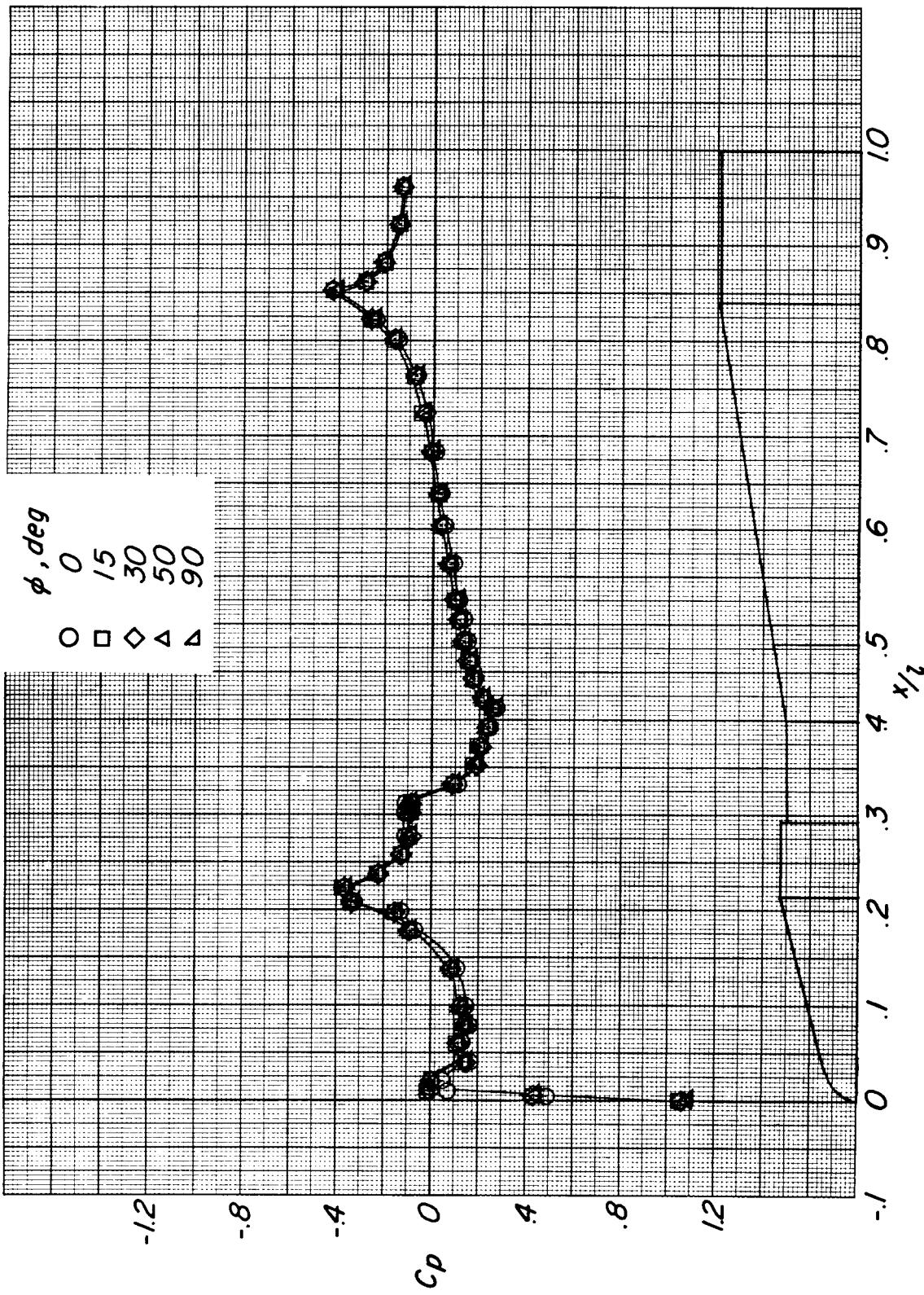


Figure 7.- Effect of roll angle on pressure distribution over model.  $\alpha = 0^\circ$ ;  $M = 0.585$ .

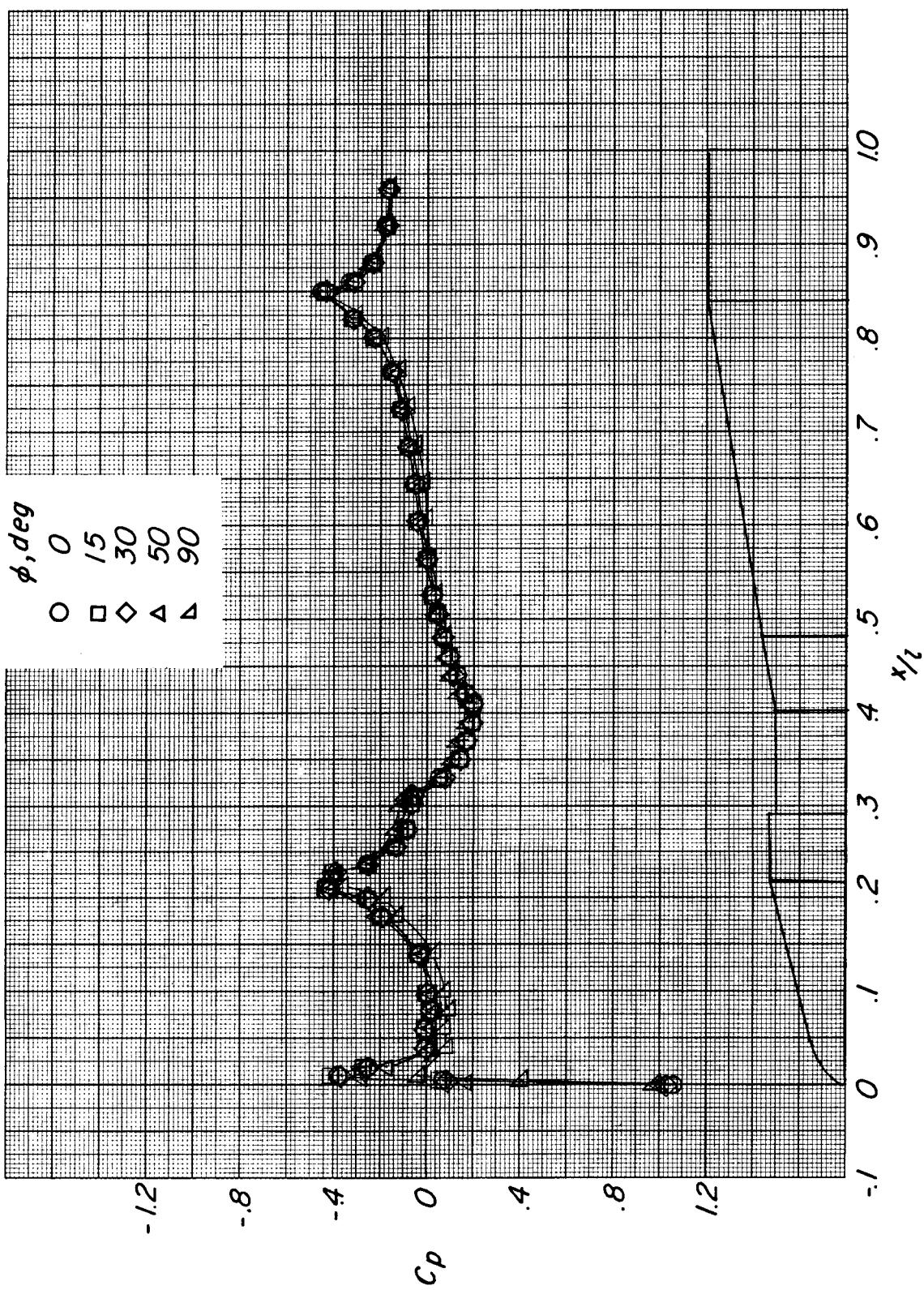


Figure 8.- Effect of roll angle on pressure distribution over model.  $\alpha = 8^\circ$ ;  $M = 0.585$ .